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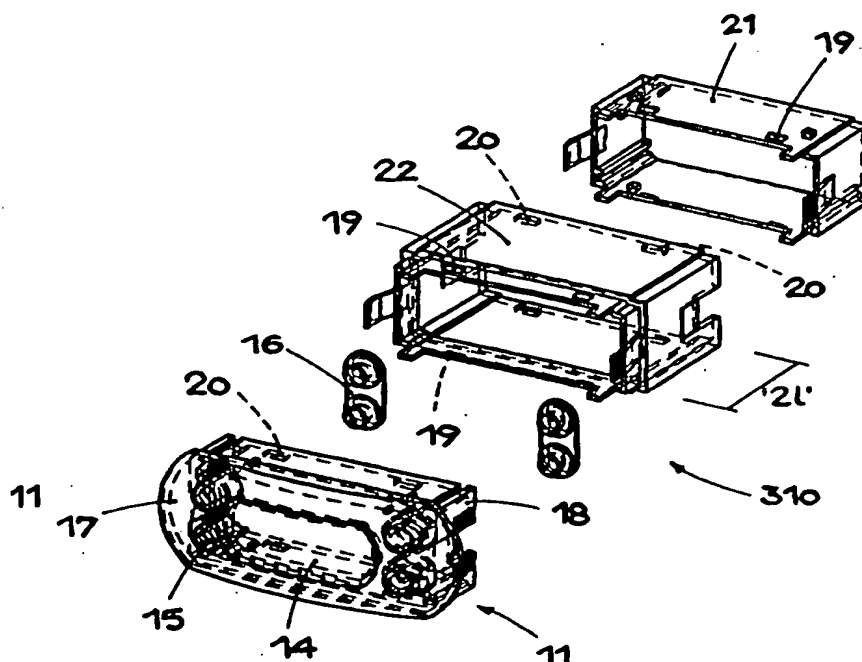
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁷ : H05K 5/00, G01D 11/24		A1	(11) International Publication Number: WO 00/08901
			(43) International Publication Date: 17 February 2000 (17.02.00)
(21) International Application Number: PCT/IB99/01367		(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).	
(22) International Filing Date: 2 August 1999 (02.08.99)		Published With international search report.	
(30) Priority Data: UD98A000146 7 August 1998 (07.08.98) IT			
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(54) Title: SYSTEM OF MODULAR HOUSINGS FOR ELECTRONIC INSTRUMENTS

(57) Abstract

System of modular containers for electronic instruments of measurement, conditioning, refrigeration and regulation, comprising a front piece equipped with a display unit and setting and command means, and at least a box-like container, the system being suitable to define a family of instruments, different in size and performance, all having a standardised size in width correlated to the size of the panel seating on which they are assembled and a depth which varies according to the functions which each of the instruments has to perform, the system comprising a unified front piece (11) with a length, or depth, of a basic measurement ("1") defining the size in length of the smallest instrument in the range, at least one closing bottom (21) with a length, or depth, equal to a finite multiple of the basic measurement ("1") and an extension module (22) with a length, or depth, equal to a finite multiple of the basic measurement ("1"), the front piece (11), the bottom (21) and the extension module (22) all having the same unified and standardised width.



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SYSTEM OF MODULAR HOUSINGS FOR ELECTRONIC INSTRUMENTS

* * * * *

FIELD OF THE INVENTION

5 This invention concerns a system of modular containers for electronic instruments of measurement, conditioning, refrigeration and regulation as set forth in the main claim.

The invention is applied in the field of production of electronic instruments, with extremely limited outer size, suitable to be panel-mounted in seatings of a standardised size arranged for the purpose on the walls of refrigeration cabinets, display cases, freezers, conditioning units and similar.

15 These instruments are suitable to be used as regulators and/or measurers in general, particularly in the field of refrigeration and of regulating and conditioning temperature, pressure and/or humidity.

Such instruments essentially comprise a front piece equipped with a display unit and setting and command means, and a box-like container equipped with means to interface and connect with the outside; the box-like container houses the components needed to make the instrument work.

25 The invention offers a rational and economical solution to those problems relating to the production of a unified and standardised range of instruments which are different in size and performance.

These instruments need to satisfy, at the same time, extremely restrictive dimensional limitations, given the limited and standardised size of the panel seatings in normal conditioning and refrigeration apparatus, and requirements of extreme variability in the functions and capacities which an instrument of different type, but belonging to the same family, must be able to achieve.

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BACKGROUND OF THE INVENTION

The state of the art includes electronic instruments of the type employed to measure and condition the parameters of a room, for example the temperature and humidity, or of a cooling unit, a heating system or similar.

These instruments are usually applied in the panel, in a suitable hole or aperture of standardised size made on the wall of a refrigeration or conditioning apparatus, making the front piece, with the display unit and the setting and command organs, protrude.

The box-like containing body is positioned inside the hole or aperture, which is often extremely limited in size; the box-like body contains the electronic components needed to make the instrument work, to feed it, to connect it to the external organs which it manages and commands, and possibly to interface with data acquisition means and remote control means.

Instruments known to the art are usually diversified according to the type of application and the services they have to supply, within a range which goes from a minimum depth for the simplest instrument and with the lowest performance to a maximum depth for the most complex instrument suitable to provide extremely varied and sophisticated services and functions.

Therefore, producers have to include a plurality of components, such as front pieces, boxes, containers, masks, assembly elements and other, which are different for every size and model of the instrument.

This obviously creates problems in the standardisation of the production equipment, such as the molds or similar, and equally obviously it creates problems in managing supplies, which in some cases can be out of proportion and in other cases may not satisfy the customers' peaks of demand.

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Moreover, producers are not able to provide customers with the possibility of modifying an instrument which they have already bought, to make it more powerful and extend its use, except by replacing the whole instrument.

5 In fact, an instrument already installed may be required to extend its operating capacities, or to be able to functionally connect the apparatus or the piece of furniture on which it is assembled with a central unit which manages the functioning of a plurality of similar devices, or yet
10 again, to extend the parameters which have to be controlled and managed.

In the face of these changing functions, conventional instruments are not able to be re-configured, also given the limits of size to which they are subject due to the afore-
15 mentioned limited size and standardised width of the positioning seatings in which they are installed.

This entails a limit to the versatility of these instruments and an increase in costs and installation times for the customer when, as in the case cited above, he wishes
20 to extend the use of an instrument of this type.

EP-A-133 301 describes a system with modular containers used to achieve electronic instruments mainly for the table, such as mice, remote controls or similar.

This system comprises a front piece, a rear closing piece
25 and one or more intermediate frames equal to the front piece.

The front piece is used to mount a keyboard, switches, a joy stick or similar.

The rear piece has recesses or cavities for the
30 positioning of screws or flanges for assembly to a wall.

Each of the frame elements has a flange part on which the electronic card with the components can be assembled by means of screws.

The modular nature of the containers disclosed in EP'301 is not correlated to any requirement of modularity, even functional, of the electronic instrument, or by any constraint of standardisation and limitation of the spaces available in a housing seating provided in a panel on a conditioning and refrigeration device.

EP-A-167478 describes an electronic instrument which can be enlarged in width and not in depth, and which is not suitable for a panel application in seatings which are standardised in the size of their front bulk, nor for an application where the physical modularity is closely connected with the functional modularity of the instrument itself.

The present Applicant has designed and embodied this invention to overcome these shortcomings and to obtain further advantages as will be shown hereafter.

SUMMARY OF THE INVENTION

The invention is set forth and characterised in the main claim, while the dependent claims describe other characteristics of the invention.

The purpose of the invention is to provide a standardised system of modular containers, suitable for panel mounting, for electronic instruments of measurement, conditioning, refrigeration and regulation which will make possible to standardise production, reducing to a minimum the number of elements needed to obtain a range of products which differ in size and performance.

The electronic instruments to which the system according to the invention is applied are used on refrigeration cabinets, display counters, freezers, conditioning units or similar, which include holes or apertures defining housing seatings with a standardised and, often, extremely limited front size.

Another purpose is to enable customers, at a later time, to extend the performance of the instrument by means of a simple and quick reconfiguration of the original instrument.

With the modular containers according to the invention, in fact, the physical modularity is closely connected to the functional modularity of the electronic instrument; this is because every container comprises modules the size of which is standardised at least with respect to the front bulk, or width, and the depth of which is correlated to the functions and operating capacities which the components present inside are able to achieve.

In fact, the same instrument may be required to achieve functions which were not initially provided, for example in the case that the relative device must be connected in series with a central control unit, and therefore the electronic instrument needs the addition of interface systems, communication systems, transmission/reception of data and processing.

The instrument may also be required to control parameters which were not initially foreseen, or, after a period of time, to manage parameters which had not been hypothesised before and which could not be achieved with the components originally included in the instrument.

In these cases, an instrument achieved with the system of modular containers according to the invention can be extended physically and functionally, starting from a basic size which substantially defines the minimum functions which the instrument is able to perform, to reach a maximum size in depth which embodies the maximum operating and functional capacities which the instrument is capable of.

A further purpose is to optimise the management of supplies, inasmuch as the system reduces to a minimum the number of different pieces which can be used in various

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assembly forms so as to achieve a plurality of instruments which are different in size and function.

5 The system of modular containers according to the invention therefore allows to achieve a series of panel-mountable instruments with a unified and standardised width, which remains constant for all types of instrument in the range, and a length, or depth, which can vary according to the type of instrument and the services it is able to provide.

10 The invention provides to define a basic measurement with a minimum depth which defines the length of the smallest instrument in the range; this basic measurement corresponds to the length or depth of the standardised front piece alone and is the same for all the instruments of the range.

15 The front piece of the instruments according to the invention carries the electronic components for feed and outside interface which are sufficient to achieve the minimum functions required of the smallest instrument in the range.

20 Then, the invention includes at least one closing bottom which can be associated with the front piece and which has a length equal to a finite multiple of the basic measurement; the invention also includes one or more extension modules which also have a length equal to a finite multiple of the
25 basic measurement.

Each extension module is able to have assembled on it, and to contain, electronic components suitable to increase the capacities and functions which can be achieved by the instrument according to the invention; each physical
30 increase of the instrument, in the sense of depth, is closely connected with an increase in its functions, linked for example to the need to perform new functions, to a serial connection not originally foreseen, to the need to

control new parameters, etc.

Therefore, by combining the front piece, the closing bottom, and one or more extension modules in different combinations, on the one hand we obtain a range of instruments which differ in depth and, therefore in performance, using a minimum number of different pieces and therefore achieving the advantages mentioned above; on the other hand we obtain the possibility of extending the capacities and performance of the instrument at a subsequent time, after the first installation.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other advantages and characteristics of the invention will be evident from reading the preferential embodiment of the invention, taken with reference to the attached drawings, wherein:

Fig. 1 is an exploded view of an example of an instrument intended as the base element of the range which can be obtained with the modular container system according to the invention;

Figs. 2, 3, 4, 5 and 6 show different assembly examples of the modular container system according to the invention to achieve the entire range of instruments diverse in size and/or performance.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Fig. 1 is an exploded view of the containing structure of the smallest instrument 10 in the range, which comprises a standardised front piece 11, which is the same for the whole range, a display card 12a, optionally equipped with a microprocessor, a card 12b to connect with the outside and a closing element 13.

In the following description, the term "instrument" should be taken to mean only the outer containing structure of the instrument proper, inside which are housed the components

needed for the instrument to function; these components are not shown here in any greater detail and in their entirety.

The front piece 11 consists of a front mask 17, defining the visor 14 of the display unit and the holes 15 to insert the keys 16 to command and set parameters, and of lateral containing walls 18 defining the inner space to house the cards 12a and 12b.

According to a variant which is not shown here, the keys 16 are made directly on the front mask 17.

10 The lateral containing walls 18 have a length or depth which defines the basic measurement "l" which is valid for all the instruments in the range.

In a preferential embodiment the basic measurement is 15 mm.

15 The instrument 10 shown in Fig. 1 is assembled by inserting the cards 12a and 12b inside the walls 18 of the front piece 11 and closing the front piece 11 at the rear with the closing element 13, which has no thickness protruding from the bulk of the front piece 11 itself, so that the length or depth of the finished instrument 10 is still equal to the basic measurement, that is, "l".

20 The closing element 13 and the front piece 11 are assembled by means of groove-and-tongue joins with tongues 19 of a male type which connect in mating seatings 20 of a female type made on the lateral walls 18.

25 The front piece 11, as it is embodied and structured, forms an instrument in itself, since the presence of the cards 12a and 12b and the visor 14 assembled directly on the front piece 11 makes possible to obtain a finished device of extremely small size, which can be panel assembled in a prepared seating, and which can perform the functions required of the basic category of the family of instruments which can be achieved with the system of containers

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according to the invention.

The instrument 110 shown in Fig. 2 constitutes a second functional category with respect to the instrument 10, and is obtained by associating with the front piece 11 a first closing bottom 21, which has a length, or depth, equal to the basic measurement "l" so that the overall depth of the instrument 110 is equal to two basic measurements.

The first closing bottom 21 also has male-type tongues 19 which couple with the seatings 20 in the front piece 11.

The closing bottom 21 is prepared to house and contain components, for example cards, chips, connectors, feeders and otherwise, which achieve an extension of the services and operating capacities of the instrument 110 with respect to the basic category defined by the instrument 10.

The functional modification can be defined at the origin, assembling immediately an instrument of this type and with this size in length suitable to fulfil a certain series of functions and services, or even during the life of the instrument, by modifying the physical and functional configuration of the instrument by simply re-assembling the containers 11 and 21 with the relative components assembled inside.

The instrument 210 shown in Fig. 3 constitutes a further evolution and is obtained by including a second closing bottom 121 which has a depth equal to two basic measurements "l", so that the overall depth of the instrument 210 is equal to three basic measurements.

The closing bottoms, the first 21 and the second 121, have on their rear the means to connect with the organs commanded by the relative instruments and for any possible control means and remote data acquisition means, so that they are immediately inter-changeable and allow to extend the functions of the instrument simply and quickly.

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The instrument 310 shown in Fig. 4 is obtained by using the front piece 11, the first closing bottom 21 and an extension module 22 of a length, or depth, equal to two basic measurements "l".

5 The overall length of the instrument 310 is therefore equal to four basic measurements.

The extension module 22 has at its front part the male-type tongues 19 to couple with the female-type seatings 20 present on the front piece 11, and at the rear has the
10 female-type seatings 20 to couple with the male-type tongues 19 present on the first closing bottom 21.

The instrument 410 shown in Fig. 5 consists of the front piece 11, the extension module 22 and the second closing bottom 121, thus defining a length equal to five basic
15 measurements.

As can be seen from the embodiment described here, the modular container system according to the invention makes possible to obtain, starting from a unified front piece 11 configured as a finished instrument in itself defining the
20 minimum category of the range, from two closing bottoms 21 and 121 and from one or more extension modules 22, an almost unlimited series of instruments of differing capacities and performance.

The physical extension of an instrument, closely connected
25 to the functional extension, is extremely simple and quick, since all it requires is that a bottom 21, 121 be replaced or an extension module 22 be added to the already existing configuration, with a consequent reconfiguration of the inner components obtained by means of the functional
30 connection of the components assembled on the added modules with the components included in the modules already present.

The example shown in Fig. 6 shows an instrument 510 consisting of the front piece 11, three equal extension

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modules 22, and the first closing bottom 21, to achieve an instrument equal in length to eight basic measurements.

The Figure also shows a unified assembly rod 23 which can be used to attach the instrument to the relative panel seating included in the piece of furniture or apparatus on which the instrument is mounted.

The assembly rod 23 has guides 24 in its inner part which engage on mating longitudinal grooves 25 on the front piece 11, and gripping teeth 27 which co-operate with knurled areas 28 present on the front piece 11.

The assembly rod 23 also has bushings 26 into which attachment screws are inserted.

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CLAIMS

- 1 - System of modular containers for electronic instruments of measurement, conditioning, refrigeration and regulation, the instruments being suitable to be panel assembled on a seating provided in a device such as a refrigerated piece of furniture, a refrigerated cabinet, a display case or similar, and comprising a front piece equipped with a display unit and setting and command means, and at least a box-like container, equipped with means to connect with the outside and which houses the components needed to make the instrument function, the system being characterised in that it is suitable to define a family of instruments, of different categories according to size and performance, all having a standardised size in width correlated to the size of the panel seating on which they are mounted and a depth which varies according to the functions which each of the categories of instruments has to perform, the system comprising a unified front piece (11) with a length, or depth, of a basic measurement ("1") defining the size in length of the smallest instrument in the range, at least one closing bottom (21) with a length, or depth, equal to a finite multiple of the basic measurement ("1") and an extension module (22) with a length, or depth, equal to a finite multiple of the basic measurement ("1"), the front piece (11), the bottom (21) and the extension module (22) all having the same unified and standardised width.
- 2 - System as in Claim 1, characterised in that it comprises a first closing bottom (21) with a length, or depth, equal to a basic measurement ("1") and a second closing bottom (121) with a length, or depth, equal to two basic measurements ("1").
- 3 - System as in Claim 1 or 2, characterised in that the extension module (22) has a length, or depth, equal to two

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basic measurements ("1").

4 - System as in Claim 1, characterised in that the front piece (11) is substantially configured as a finished instrument in itself and is suitable to contain and/or support components (12a, 12b, 14) suitable to perform the functions required of the basic category of the family of instruments.

5 - System as in Claim 4, characterised in that said components comprise at least a display card (12a) possibly equipped with a microprocessor, a card (12b) to connect with the outside and a visor (14).

6 - System as in any claim hereinbefore, characterised in that an instrument (110), with a containing structure defined by assembling a front piece (11) and a first closing bottom (21), constitutes a second category, functionally more evolved, of the family of instruments.

7 - System as in any claim hereinbefore, characterised in that an instrument (210), with a containing structure defined by assembling a front piece (11) and a second closing bottom (121), constitutes a further category, functionally more evolved, of the family of instruments.

8 - System as in any claim hereinbefore, characterised in that an instrument (310), with a containing structure defined by assembling a front piece (11), a closing bottom (21, 121) and at least an extension module (22), constitutes a further category, functionally still more evolved, of the family of instruments.

9 - System as in any claim hereinbefore, characterised in that the front piece (11), the closing bottoms (21, 121) and the extension module (22) are assembled by means of male-female coupling joins.

10 - System as in Claim 9, characterised in that at the rear the front piece (11) has female-type seatings (20) able to

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be associated with mating male-type tongues (19) on the front part of the closing bottoms (21, 121) and on the extension module (22).

11 - System as in Claim 9, characterised in that at the rear
5 the extension module (22) has female-type seatings (20) able to be associated with mating male-type tongues (19) on the front part of the closing bottoms (21, 121).

12 - System as in any claim hereinbefore, characterised in that it comprises a closing element (13) suitable to be
10 included in the longitudinal bulk of the front piece (11) equipped with male-type tongues (19) and able to be associated with the front piece (11) so as to define the minimum size of the instrument of measurement, conditioning and regulation.

13 - System as in Claim 1, characterised in that the front
15 piece (11) comprises a front mask (17) defining a visor (14) able to be associated with the display unit and holes (15) for the insertion of setting and command means (16), and lateral containing walls (18) defining the housing for cards
20 (12a, 12b).

14 - System as in Claim 1, characterised in that the setting and command means (16) are made directly on the front mask (17).

15 - System as in any claim hereinbefore, characterised in
25 that it comprises an assembly rod (23) of a unified type with a flange, which can be associated by connection to the front piece (11) so as to clamp the instrument in the assembly seating.

16 - System as in Claim 15, characterised in that the
30 assembly rod (23) has assembly guides (24) able to be associated with respective grooves (25) on the front piece (11) and gripping teeth (27) able to be associated with gripping areas (28) on the front piece (11).

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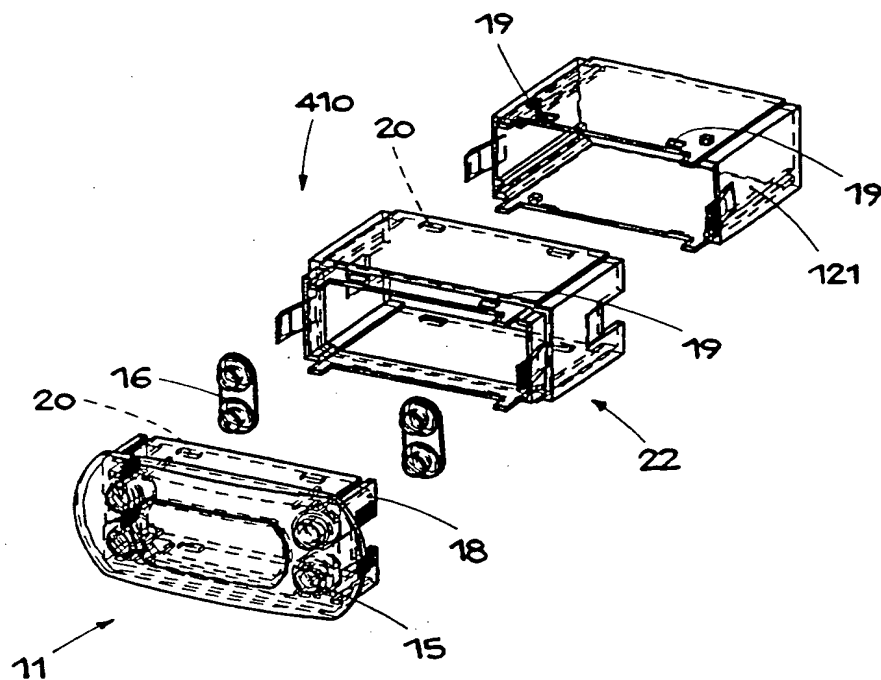


fig.5

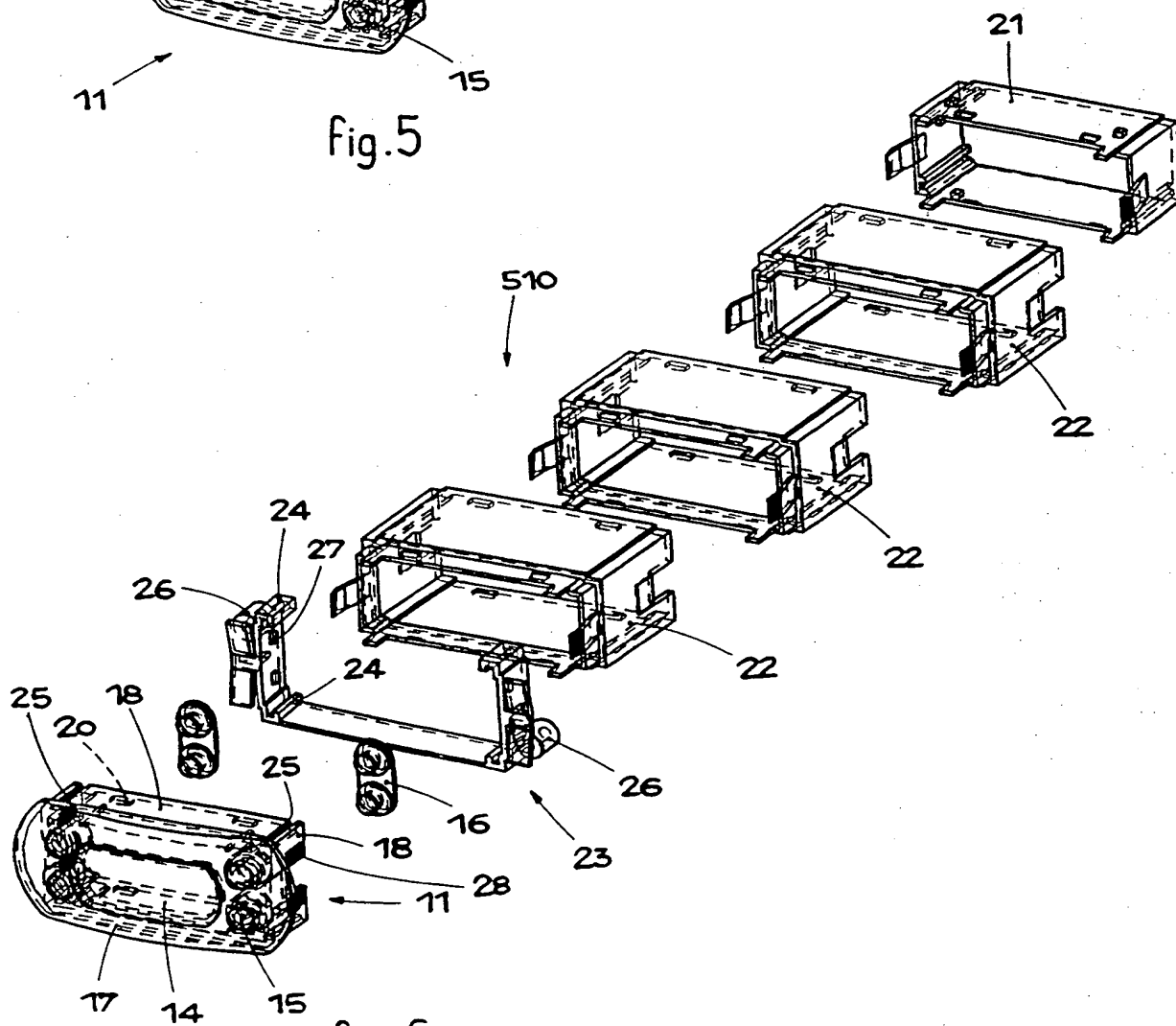


fig.6

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 H05K5/00 G01D11/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	---	2
A	EP 0 167 478 A (SIEMENS AG) 8 January 1986 (1986-01-08) cited in the application page 4, line 14 -page 5, line 4; figure 1	1, 12

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INTERNATIONAL SEARCH REPORT

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Publication No

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